

POST FLEDGING BEHAVIOR OF FERRUGINOUS HAWKS IN NORTH DAKOTA

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ABSTRACT - Post-fledging activities of 18 Ferruginous Hawks (*Buteo regalis*) were studied in southcentral North Dakota during July and August 1979. The post-fledging period ranged from 10 to 40 d (\bar{x} = 23.1 d; N = 16). Haylands and native prairie grasslands were the principal land use types utilized by fledglings and adults. Mortality of young during post-fledging was 11% (N = 2).

Brown and Amadon (1968) concluded that mortality rates were high for young hawks during the post-fledging period. However, increased mobility of fledglings creates problems in collecting information on their daily activities during this period. Consequently, little information is available about post-fledging periods (the time between leaving the nest and leaving the home range) of young raptors. Angell (1969), Lokemoen and Duebbert (1976), Thurow, et al. (1980), Powers (1980), and Harmata (1981) described some aspects of post-fledging activities of the Ferruginous Hawk (*Buteo regalis*). In recent years the use of radio telemetry has provided an effective but expensive method of studying post-fledging behavior. Blair and Schitosky (1982) studied 6 fledgling Ferruginous Hawks using radio telemetry in South Dakota, and Ensign (1983) and Woffinden and Murphy (1983) each studied 2 fledgling Ferruginous Hawks with radio telemetry equipment in Montana and Utah, respectively.

We studied post-fledging activities of Ferruginous Hawks in an area of North Dakota with an abundant nesting population (Gilmer and Stewart 1983) and open, flat terrain that facilitated observations of color-marked hawks. The study objectives were (1) to determine lengths of post-fledging periods for Ferruginous Hawks, (2) to assess habitat use by fledglings and adults relative to land use types surrounding nest sites, and (3) to determine fledgling mortality rates during the post-fledging period.

STUDY AREA AND METHODS

The study area was located about 80 km west of Jamestown, North Dakota, an area known to have a dense nesting population of Ferruginous Hawks (Gilmer and Stewart 1983). The land surface was shaped by Wisconsin-age glaciers and topography varied from flat or gently rolling glacial outwash plains to rugged hilly areas of terminal moraine in the geologic subregion known as the Missouri Coteau. Land use practices formed a mosaic of agricultural lands and native eastern mixed-grass prairie (see Stewart 1975) interspersed with numerous wetlands. Small grains,

sunflowers (*Helianthus annuus*), and domestic hay were the principal crops grown, and native prairie grasslands served as livestock pasture.

Behavior of fledgling Ferruginous Hawks was studied from 8 July to 22 August 1979 by observing 18 fledglings raised in 4 tree nests and 1 ground nest. Four young hawks fledged from 3 nests and 3 young fledged from 2 nests. All 18 fledgling Ferruginous Hawks were banded with numbered U.S. Fish and Wildlife Service lock-on bands, and fitted with colored tail streamers for individual identification.

Tail streamers were made with colored, 4 cm wide Scotch plastic tape folded around a 2 cm wide strip of reinforced strapping tape, forming a seam midway along the ventral side of the streamer. The tail streamers measured 12.5 cm in length and the corners were trimmed off. Tail streamers were attached to the dorsal side of a central (number 1) rectrice with a fast drying, permanent bond Super Glue applied to the area of feather attachment. Four paper staples were fastened across the feather shaft in 2 Xs to assure solid contact between feathers and streamers, and to provide reinforcement. Streamers extended 5 cm beyond the end of the tail feathers. Yellow, blue, red and green colored plastic tape was used for individual identification of siblings (additional colors are also available). The bright colors and reflecting properties of the plastic tape provided a high degree of visibility. Although the tail streamers were small, they were visible on perched or flying hawks from 40 m with unaided eyes and over 300 m with 8 x 30 binoculars. The most readily visible colors in order of decreasing visibility were yellow, blue, red and green. The tail streamers were very durable, showing no wear after 5 weeks. One tail streamer was lost after 21 d. No adverse effects on movements, flight or behavior were noted.

We tried to locate each fledgling and adult from each nest daily. Each nest site was visited approximately an equal number of times during each of 4 daylight periods, 0530-0930 H, 0930-1330 H, 1330-1730 H and 1730-2130 H. Fledglings usually perched near each other on elevated sites and therefore were usually readily observed from a nearby road with binoculars or a spotting scope. Occasionally it was necessary to search surrounding areas on foot with the aid of a dog to ensure any fledglings overlooked were not hiding or dead.

High altitude, color infrared photographs (scale 1:63,360) of southcentral North Dakota acquired by the National Aeronautics and Space Administration in June 1978 were used to construct land use maps of the area surrounding each nest. These maps were checked for accuracy during ground visits. Habitat within the area was classified according to land use (i.e., native prairie, haylands, cultivated fields, or other areas including wetlands, farmsteads and roads not used by the hawks). To determine habitat use by each hawk family, locations of each fledgling and adult hawk observed during daily nest visits were plotted on the land use maps. We considered the area within 0.9 km of each nest

to contain the habitat available for use by the family group because it included the most distant sightings of adults from all nests during the post-fledging period. The habitat available to the hawks within 0.9 km of the nest (2.5 km²) was then compared with habitat the hawks were observed to use within the 2.5 km² area.

RESULTS AND DISCUSSION

Post-fledging Period.— Mean length of the post-fledging period was 23.2 d (N = 16; range 10 - 40 d) and differing by as much as 15 d among nestmates (Table 1). In South Dakota most Ferruginous Hawk family groups left nest sites soon after young fledged, but some remained in the vicinity of nests for more than 30 d (Lokemoen and Duebbert 1976). In Idaho Ferruginous Hawk family groups remained in the area surrounding the nest sites for 3 - 4 wk (Thurow et al. 1980). In Montana Ensign (1983) noted that family groups were commonly observed up to 3 wk after fledging, and 2 radio-tagged fledglings remained 4½ wk. In Utah 2 radio-tagged fledglings remained in the nesting area 20-30 d after fledging (Woffindin and Murphy 1983.)

We flushed fledglings to locate them when it was necessary and noted that their flight capabilities developed rapidly after leaving the nest. However, the fledglings were rarely observed flying until the third week after fledging when they were occasionally seen flying or soaring in the home range. Ensign (1983) noted flight was "mastered" in the second week. Increased flights were probably associated with the progressive development of the

quills of the remiges and retrices during the first 2 wk after fledging (Brown and Amadon 1968:102).

Movements of fledglings during the post-fledging period were influenced by land use practices, availability of perches, movements of adults and activities of farmers. Availability of specific habitats and associated perches appeared to determine most movements of fledglings. Perches used included fenceposts, haystacks, large round hay bales, trees and metal power line towers. Dissimilarly, Blair and Schitosky (1982) observed a consistent weekly expansion of the range of 6 radio-tagged fledglings in a homogeneous grassland. Ensign (1983) reported 2 radio-tagged fledglings traveled 1,000 m from the nest site during the second week after fledging and 1,600 m during the third and fourth weeks in a sagebrush-grassland ecotone.

Fledglings gradually became independent from adult home ranges and family units as their flight capabilities developed. All fledglings left their home ranges by 18 August. Ferruginous Hawk family groups broke up gradually. In each instance young separated from the family while adults continued to occupy home ranges after the fledglings reached independence. Fledglings may also leave the adult home range before adults in South Dakota (Blair and Schitosky 1982) and Utah (Woffindin and Murphy 1983). Newton (1979) reported there is little evidence that raptors migrate as family groups.

Habitat. — Hayfields and native prairie grasslands were the habitats used most within each home range by adults as well as fledglings (Table 2). These vegetation types provided prime hunting areas for rodents. At nests A, B, D and E hayland was used in greater proportion than its availability. In 2 instances hayfields adjacent to adult hunting fields were utilized the day of mowing and regularly thereafter, and the fledglings moved to these fields within 2 d. Becard (1980) noted a similar response for the Swainson's Hawk (*Buteo swainsoni*). Wakeley (1978a, b) reported that density of vegetation was a more critical factor in a Ferruginous Hawk's choice of hunting sites than prey density. Apparently prey are more visible in recently cut hayfields. Cultivated fields were only rarely used during the post-fledging period by Ferruginous Hawks, while wetlands, farmsteads and highways were not used during our observations.

Mortality. — Two of the 18 fledglings died during the post-fledging period. One fledgling was

Table 1. Duration (in days) of post-fledging period of Ferruginous Hawks in North Dakota, 1979.

NEST	FLEDGLING TAIL STREAMER COLOR			
	YELLOW	BLUE	RED	GREEN
A	27	28	(6) ^a	26
B	24	27	25	--
C	40	29	(10) ^b	29
D	17	19	32	--
E	10	12	13	12

^a Fledgling shot

^b Fledgling fatally injured

Table 2. Habitat use by fledgling Ferruginous Hawks relative to habitat available within 0.9 km radius of each nest in North Dakota.

NEST	NATIVE		CULTIVATED	
	PRAIRIE	HAYFIELD	FIELDS	OTHER ¹
A	58 ² -25 ³	27-70	11-5	4-0
B	8-0	39-88	52-12	11-0
C	85-100	0-0	15-0	0-0
D	19-0	27-100	39-0	15-0
E	19-3	31-97	23-0	27-0

¹includes wetlands, farmsteads and highways

²percent habitat available

³percent habitat use

shot 6 days after leaving the nest, and 1 suffered a leg injury 10 d after fledging and eventually died. The remaining 16 fledglings successfully left their natal ranges. Blair and Schitosky (1982), Ensign (1983) and Woffindin and Murphy (1983) observed no mortality during the post-fledging period among fledgling Ferruginous Hawks (N = 6, 2, 2, respectively).

CONCLUSION

This study of the post-fledging period of the Ferruginous Hawk provides information about the length of the post-fledging period, behavior observed, habitat utilized and observed mortality. The information presented can be used by land managers and land use planners to predict the period after fledging when Ferruginous Hawk fledglings and adults should be protected from disturbances that may affect mortality. While the mortality of 2 of 18 fledglings (11%) during this study may not be high for the short period studied, additional disturbances caused by local or regional developments may pose serious problems. The breeding range of Ferruginous Hawks encompasses many areas of intense energy development, including surface coal mining, oil, natural gas and geothermal exploration, drilling, exploitation, and powerline and pipeline construction. Ferruginous Hawks are a valuable indicator species due to their sensitivity to human disturbance and changes in prey popula-

tions associated with surface coal mining (Evans 1983). They may also be valuable indicators of the effects of other energy developments and the success of habitat mitigation or restoration efforts conducted in association with such developments. Energy-related development should proceed only with regard for the annual nesting chronology of Ferruginous Hawks, including the post-fledging period. Development should be delayed near active nests until 45 d after fledging to avoid disrupting post-fledging activities of Ferruginous Hawks. In some cases it may be beneficial to establish buffer zones surrounding Ferruginous Hawk nest sites. White et al. (1979) suggest restricting human activities to 0.8 km from nests and construction 1.6 km from nests. Planners working on activities not associated with energy development may also use this information to avoid disturbing Ferruginous Hawks during post-fledging activities. We urge that more investigators study the post-fledging period of raptors, as effective raptor management requires accurate information about this little-studied period in the life history of birds of prey.

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LITERATURE CITED

- ANGELL, T. 1969. A study of the Ferruginous Hawk: Adult and brood behavior. *Living Bird* 8:225-241.
- BECARD, M.J. 1980. Factors affecting nest productivity of Swainson's Hawk (*Buteo swainsoni*) in Southeastern Washington. Ph.D. Diss., Washington St. Univ., Pullman. 75pp.
- BLAIR, C.L. AND F. SCHITOSKY. 1982. Breeding biology and diet of the Ferruginous Hawk in South Dakota. *Wilson Bull.* 94(1):46-54.
- BROWN, L.H. AND D. AMADON. 1968. *Eagles, hawks, and falcons of the world*. McGraw-Hill, New York. 2 vols.
- ENSGN, J.T. 1983. Nest site selection, productivity and food habits of Ferruginous Hawks in southeastern Montana. M.S. Thesis, Montana St. Univ., Bozeman. 85 pp.
- EVANS, D.L. 1983. Ferruginous Hawk. Pages 109-123 *In* Impacts of coal surface mining on 25 migratory bird species of high federal interest. U.S. Dept. Interior, Washington, D.C.
- GILMER, D.S. AND R.E. STEWART. 1983. Ferruginous Hawk populations and habitat use in North Dakota. *J. Wildl. Manage.* 47(1):146-157.

- LOKEMOEN, J.T. AND H.F. DUEBBERT. 1976. Ferruginous Hawk nesting ecology and raptor populations in northern South Dakota. *Condor* 78(4):464-470.
- NEWTON, I. 1979. Population ecology of raptors. Buteo Books, Vermillion, S.D. 399 pp.
- POWERS, L.R. 1981. Nesting behavior of the Ferruginous Hawk (*Buteo regalis*). Ph.D. Diss., Idaho St. Univ., Pocatello. 312 pp.
- STEWART, R.E. 1975. Breeding Birds of North Dakota. Tri-College Center for Environmental Studies, Fargo, N.D. 295 pp.
- THUROW, T.L., C.M. WHITE, R.P. HOWARD AND J.F. SULLIVAN. 1980. Raptor ecology of Raft River Valley, Idaho. DOE Contract No. DE-AC07-76 ID01570. EG&G, Idaho Inc., Idaho Falls. 45 pp.
- WAKELEY, J.S. 1978a. Factors affecting the use of hunting sites by Ferruginous Hawks. *Condor* 80(3):316-326.
- WAKELEY, J.S. 1978b. Hunting methods and factors affecting their use by Ferruginous Hawks. *Condor* 80(3):327-333.
- WOFFINDEN, N.D. AND J.R. MURPHY. 1983. Ferruginous Hawk postfledging activities. *Bird Bander* 8(3):94-96.
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ERRATUM — Volume 19, Number 4, page 129, Table 1, S.R.B.P. (1979), should read . . . mammals 72%, birds 22%. In addition, S.R.B.P. Special Research Report (June 30, 1979, unreferenced) summarizes a 5-yr study of Prairie Falcon food items as . . . mammals 67%, birds 22%, reptiles 8%, invertebrates 2%.